ZOOLOGIA 37: e37384
ISSN 1984-4689 (online)
zoologia.pensoft.net

RESEARCH ARTICLE

# Updates on *Berlandiella* (Araneae: Philodromidae): a new species, description of the male of *B. querencia* and new diagnosis for the genus

**Paulo Pantoja**[1,2], **Marcos Drago-Bisneto**[1,3], **Regiane Saturnino**[4]

[1]*Laboratório de Aracnologia, Coordenação de Zoologia, Museu Paraense Emílio Goeldi. Avenida Perimetral 1901, Terra Firme, 66077-830 Belém, PA, Brazil.*
[2]*Programa de Pós-Graduação em Zoologia, Museu Paraense Emílio Goeldi, Universidade Federal do Pará. Rua Augusto Corrêa 1, Guamá, 66075-110 Belém, PA, Brazil.*
[3]*Programa de Pós-Graduação em Biodiversidade e Evolução, Museu Paraense Emílio Goeldi. Avenida Perimetral 1901, Terra Firme, 66077-830 Belém, PA, Brazil.*
[4]*Centro de Ciências Exatas, Naturais e Tecnológicas, Universidade Estadual da Região Tocantina do Maranhão. Avenida Godofredo Viana 1300, Centro, 65901-480 Imperatriz, MA, Brazil.*
*Corresponding author: Regiane Saturnino (sf.regiane@gmail.com)*

*http://zoobank.org/95E87889-A1B4-47D0-BCF4-3E48140E7467*

ABSTRACT. *Berlandiella* Mello-Leitão, 1929 is currently composed of six Neotropical species, of which *Berlandiella querencia* Lise & Silva, 2011 is known only from female specimens; the other species of the genus were described based on both males and females. In this paper, we describe and illustrate *Berlandiella zabele* **sp. nov.**, based on a few individuals collected in Sete Cidades National Park, Piracuruca and Brasileira, state of Piauí, Brazil. We illustrate and describe the previously unknown male of *B. querencia*, based on a specimen collected from Reserva Mocambo, Belém, state of Pará, Brazil. The taxa described herein have scopula in the tarsi and metatarsi, and the males have a cymbial process, characters recorded for the first time for the genus. Additionally, we present an updated diagnosis for *Berlandiella*.

KEY WORDS. Neotropical, Northern, spiders, taxonomy.

## INTRODUCTION

Philodromidae Thorell, 1870 currently comprises 31 genera, of which 18 occur in the Neotropics (WSC 2020) and only *Berlandiella* Mello-Leitão, 1929 and *Gephyrellula* Strand, 1932 have been revised (Lise and Silva 2011, Santos and Rheims 2018). *Berlandiella* was proposed to allocate three species from Brazil: *B. insignis* Mello-Leitão, 1929 (type species), *B. magna* Mello-Leitão, 1929 and *B. polyacantha* Mello-Leitão, 1929. Lise and Silva (2011) did the taxonomic revision of the genus, re-describing and designating lectotypes for the known species and describing three new species, all recorded for Brazil, as follow: *B. insignis*, *B. magna*, *B. polyacantha*, *B. meridionalis* Lise & Silva, 2011, *B. querencia* Lise & Silva, 2011, and *B. robertae* Lise & Silva, 2011 (*B. robertae* is also recorded as occurring in Argentina). Most *Berlandiella* species are distributed in the south, southeast, and central-west regions of Brazil, with an isolated record of *B. magna* from the state of Piauí, Brazil and *B. querencia* from the state of Mato Grosso, Brazil. In this context, we present here the first record of the genus for northern Brazil, from the interior of the Amazon Basin.

According to Lise and Silva (2011), *Berlandiella* species are similar to *Cleocnemis* Simon, 1886 and *Paracleocnemis* Schiapelli & Gerschman, 1942, in the general body morphology; however, *Berlandiella* differs from these two genera by the absence of scopula in the tarsi and metatarsi and differs from all other Philodromidae genera by an unique set of characters: relatively high carapace, legs relatively short and densely covered by bristles (Fig. 1), and tarsi with dense claw tufts (Lise and Silva 2011). In addition, Lise and Silva (2011) described the *Berlandiella* male palp as possessing the following characters: cymbium covered by bristles, short and curved embolus, wider at the base, emerging from the apex of the tegulum, and tibia with a retrolateral tibial apophysis (RTA). According to Lise and Silva (2011), females of *Berlandiella* have a weakly depressed epigynum with a large spermathecae, usually elliptical, and with a glandular head.

Based on the revision provided by Lise and Silva (2011), it was possible to identify a new species of *Berlandiella* from Brasileira and Piracuruca, Piauí, named here as *B. zabele* sp. nov., composed of both sexes, and a couple of the known species *B. querencia* from Belém, Pará, whose male was unknown until

Figure 1. Juvenile *Berlandiella querencia* in vivo. Author: César Favacho.

now and is here described for the first time. In addition, we recorded the presence of scopula in the tarsi, metatarsi and palp of some species of *Berlandiella*, and recorded structures that may be present in the palp of males, such as a cymbial process. In this context, we present an updated diagnosis for *Berlandiella*.

## MATERIAL AND METHODS

The specimens were analyzed with a Leica MZ16 stereomicroscope and the illustrations were made with the assistance of a camera lucida attached to a stereomicroscope. Descriptions follow Lise and Silva (2011) and morphological terminologies follow Muster and Thaler (2004) and Muster (2009). Herein we record the position of the ventral macrosetae of the tibiae and metatarsi I-II according to Lise and Silva (2011), but we highlight the fact that there is no regular pattern of spination for species, since leg macrosetae I-II vary in number and position between individuals, and even between left and right legs. All measurements are in millimeters. Color images were obtained on a Leica M205 A stereomicroscope, coupled with a Leica MC170 HD digital camera. The LAS v. 4.9 software was used to generate extended focal range images. The scanning images were obtained with Mira 3 Tescan scanning electron microscope housed at the Laboratório Institucional de Microscopia Eletrônica de Varredura of the Museu Paraense Emílio Goeldi. For all scanning images, samples were submitted to an ultrasonic washer to clean surfaces. Then, the samples were gradually dehydrated in series of ethanol concentrations (80%, 90%, 96%, and 100%), subjected to critical-point drying and coated with gold. The distribution map of the species was elaborated with the program QGis 2.18 (QGIS 2019). The material examined is deposited in the Museu Paraense Emílio Goeldi (MPEG, curator A. Bonaldo) and Coleção de História Natural da Universidade Federal do Piauí (CHNUFPI, curator E.F.B. Lima). Abbreviations for the measurement of the eyes: (ALE) anterior lateral eyes, (AME) anterior median eyes, (PLE) posterior lateral eyes, (PME) posterior median eyes, (MOQ) median ocular quadrangle.

## TAXONOMY

### Philodromidae Thorell, 1870

### *Berlandiella* Mello-Leitão, 1929

*Berlandiella* Mello-Leitão, 1929: 107, 122, 260, 264, 265 (type species *Berlandiella insignis* Mello-Leitão, 1929, by original designation). Lise & Silva, 2011: 350–373.

Updated diagnosis. *Berlandiella* is similar to *Paracleocnemis*, *Procleocnemis* Mello-Leitão, 1929 and *Metacleocnemis* Mello-Leitão, 1929 due to general morphology, however, differs from *Metacleocnemis* for having little evident thoracic fovea; from *Procleocnemis* due to smaller and closer PME relative to the PLE, oval abdomen and legs III-IV of similar length to legs I-II; they differ from *Paracleocnemis* in having a longer than wide cephalothorax and posterior eye row more recurved than the anterior. *Berlandiella* is distinguished from the other neotropical genera of Philodromidae by the following set of characters: carapace covered by erect and robust bristles (Figs 19–20), elongated oval abdomen, legs of similar size, densely covered with bristles (Fig. 43) and strong ventral macrosetae (Figs 1, 41), metatarsi I-II much smaller compared to the tibiae; epigynum with a more or less wide epigynal groove and small copulation opening (Figs Figs 4–7, 29, 30); male palpus covered with bristles (Fig. 13), bulky and ellipsoid bulb (Figs 8, 9, 31, 32), free and short embolus (Figs 8, 11, 12, 31), cymbial process present or absent (Figs 8-10, 15, 16, 31-33).

Figures 2–5. *Berlandiella zabele* sp. nov.: (2) female holotype habitus (MPEG.ARA 34482); (3) male paratype habitus (MPEG.ARA 34480); (4) epigynum, ventral; (5) epigynum, dorsal clarified. Scale bars: 2–3: 1 mm, 4–5: 0.2 mm.

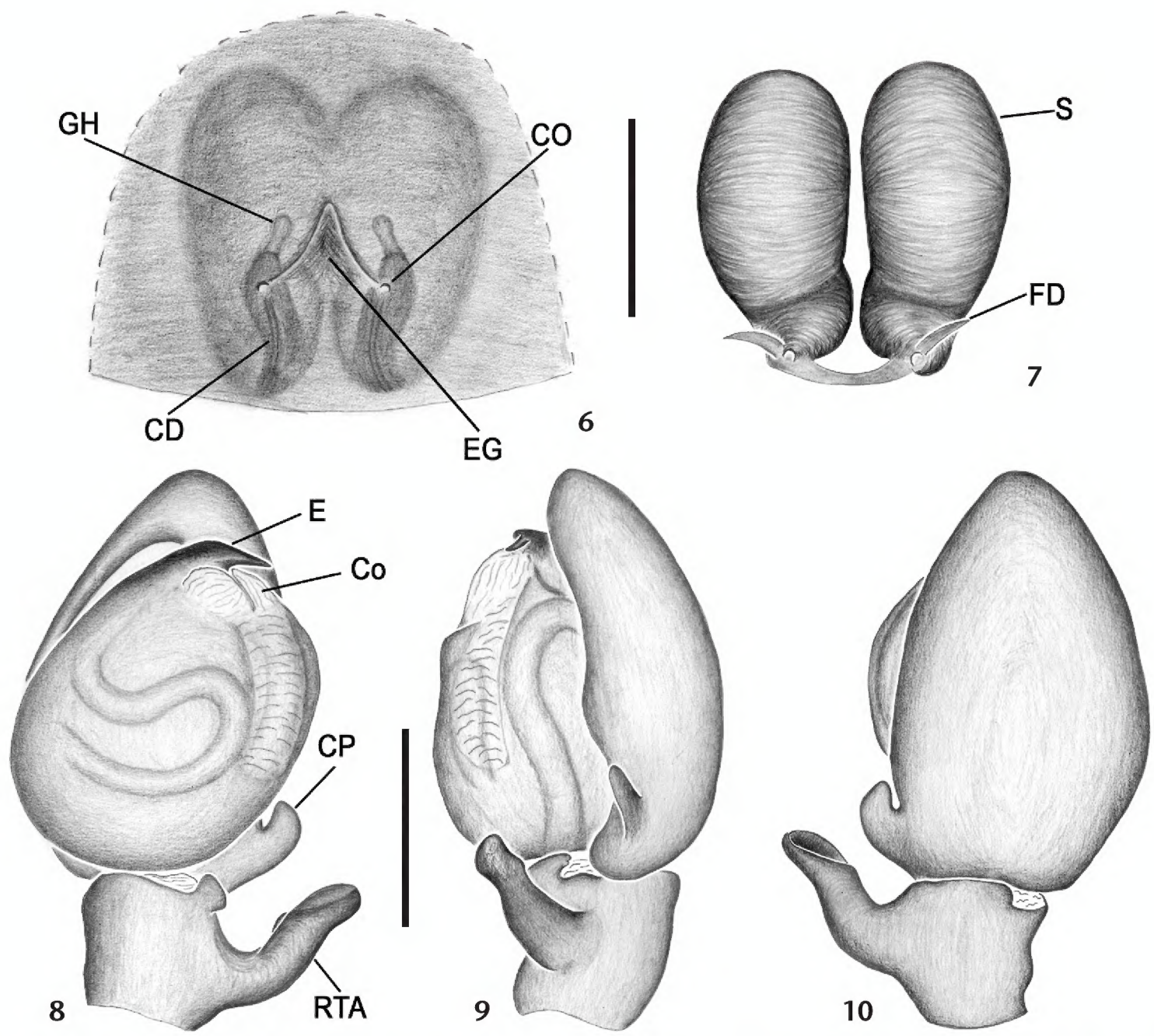
## *Berlandiella zabele* sp. nov.

http://zoobank.org/A284875E-3883-478C-9361-B2D39576009F
Figs 2–26, 41, 43, 44

Type-material. Holotype. BRAZIL, 1 female from Piracuruca, Parque Nacional de Sete Cidades, 04°05'55.4"S, 41°42'33.2"W, 24 Jun. 2005, LS Carvalho leg. (MPEG.ARA 34482). Paratypes. BRAZIL, 1 male from Brasileira, Parque Nacional de Sete Cidades, 04°08'08.2"S, 41°43'08.4"W, 29 Jan. 2007, LS Carvalho et al. leg. (MPEG.ARA 34480); 1 male, same collection data as for preceding, 04°05'39.9"S, 41°43'53.3"W, 26 Jan. 2007, LS Carvalho et al. leg. (CHNUFPI 3398); 1 male, same collection data as for preceding, 24 Jan. 2007, LS Carvalho et al. leg. (MPEG.ARA 15585); 1 female, same collection data as for preceding, 22 Jan. 2007, LS Carvalho leg. (MPEG.ARA 15579).

Diagnosis. The female of *Berlandiella zabele* sp. nov. is similar to *B. magna* and *B. querencia* by the long and ellipsoid spermathecae (Figs 4–7), but are distinguished from those species by having its copulation opening more widely separated from each other and located on the posterior edge of the epigynal groove (Figs 4, 6). The male resembles *B. querencia* in possessing a cymbial process (CP), but differs by the position of the CP, closest to the cymbium (Figs 8–10, 13, 15, 16), by the long retrolateral tibial apophysis (RTA), excavated in the distal portion (Figs 8–11, 15, 16).

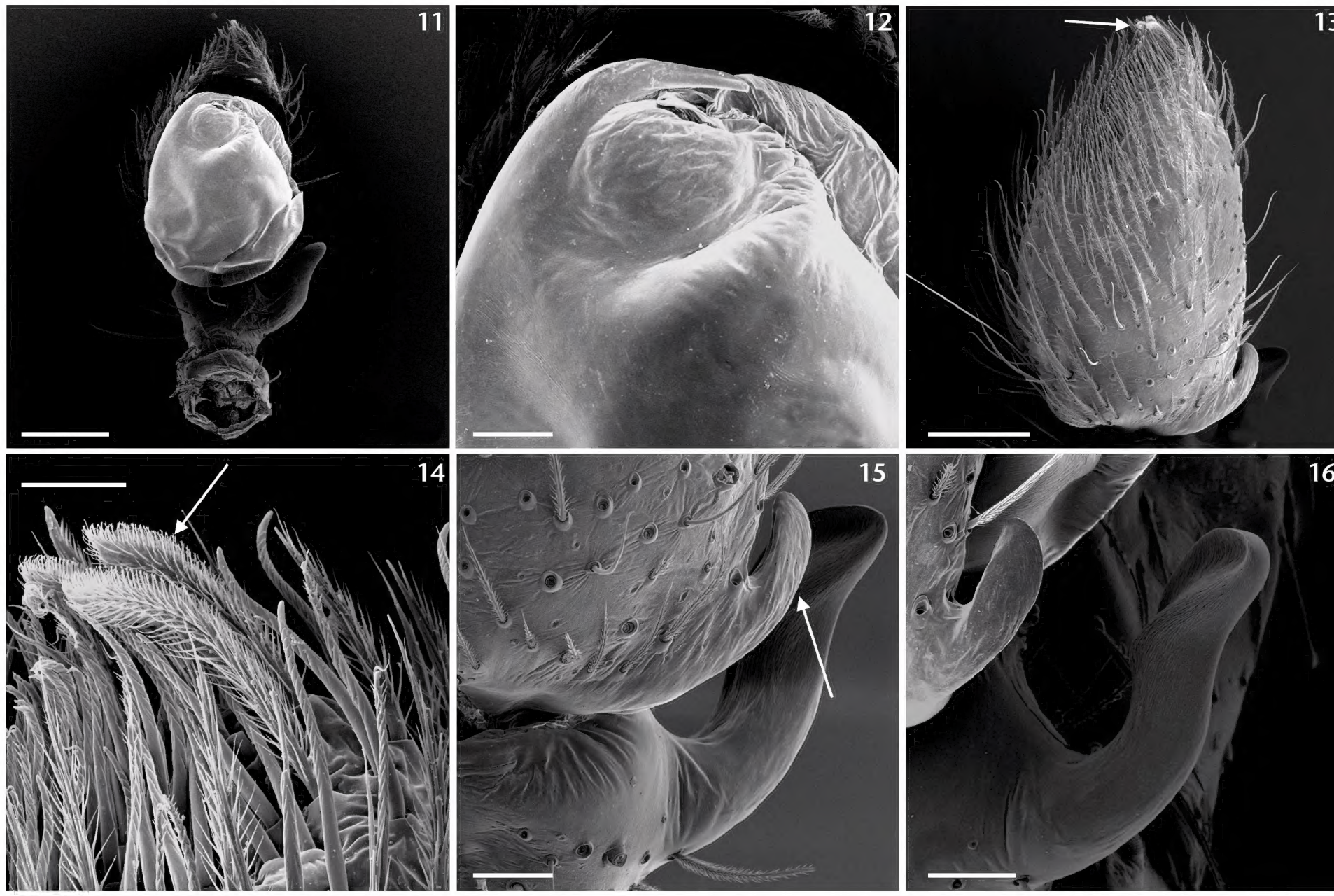
Description. Female (holotype – MPEG.ARA 34482). Carapace slightly longer than wide, wider at the level of legs III, narrowed anteriorly, with many sockets of bristles; median region yellow with a brown central spot and wide dark brown bands on each side, formed by a tangle of dark spots. Clypeus vertical with many sockets of bristles, with a median brown spot and irregular spots on lateral. Chelicerae yellow with two teeth on the promargin of the fang furrow, with a large dark brown spot on the anterior face. Labium orange with rounded




Figures 6–10. Genitalia of *Berlandiella zabele* sp. nov.: (6) epigynum ventral; (7) epigynum dorsal; (8) palp, ventral; (9) palp, retrolateral; (10) palp, dorsal. CD: copulatory ducts, CO: copulatory opening, Co: conductor, E: embolus, EG: epigynal groove, FD: fertilization duct, GH: glandular head, CP: cymbial process, RTA: retrolateral tibial apophysis, S: spermatheca, VTA: ventral tibial apophysis. Scale bars: 0.3 mm.

apex, reaching almost to the middle of the endites. Endites pale yellow, excavated diagonally. Sternum pale yellow. Legs covered by various types of setae and with many robust macrosetae on tibiae and metatarsi. Left and right tibiae I with 0–2–2–0 ventral macrosetae, left metatarsus I with 2–2–0 and right metatarsus I with 2–2–1 ventral macrosetae. Left and right tibia II with 0–2–2–0 ventral macrosetae and right metatarsus II with 2–2–1 ventral macrosetae. Tarsi and metatarsi with scopula. Long and thin trichobothria in tarsi and metatarsi, with distal and proximal plate limit well differentiated; the distal margin of the trichobothrial hood is well defined; hood entire, differentiated with transverse ridges; alveolus notched; distal plate smooth, slightly elevated. Femura yellow with brown spots, more abundant in prolateral sides of femora I-III, and a small white spot at the apex; patellae I-III yellow with brown spots; patella IV yellow; tibiae and metatarsi I-III yellow, shaded with brown, but tibia and metatarsus III darker; tibia IV yellow with a basal dark spot on prolateral side; tarsi I-IV yellow, with a dark ring at their bases. Tarsal claw pectinate and conspicuous with claw apex tooth curved and seven short and robust teeth. Palp yellow with brown spots. Abdomen yellow, longer than wide, densely covered by setae sockets, the dorsum covered by a wide brown spot with two longitudinal yellow bands around the heart mark; laterals yellow shaded with brown and the venter yellow stippled with brown. Triangular epigynal groove, shallow, demarcated by sclerotized edges, small and widely spaced copulatory openings, elliptical and elongated spermathecae, thickly covered with punctuations.

Measurements. Total length 3.72. Carapace 1.85 long, 1.62 wide, 0.59 high. Chelicerae 0.57 long, 0.33 wide. Labium 0.30 long, 0.23 wide. Endites 0.43 long, 0.20 wide. Sternum 0.96 long, 0.89 wide. Clypeus 0.27 high. Abdomen 2.58 long, 1.66 wide, 1.22 high. Leg: I. femur 1.54; patella 0.72; tibia 1.27; metatarsus 1.04; tarsus 0.50; total length 5.07; II. 1.68; 0.72; 1.39; 1.13; 0.76; 5.68; III. 1.42; 0.63; 1.07; 0.97; 0.51; 4.60; IV. 1.17; 0.63; 1.12; 1.18; 0.61; 4.71. Leg formula II-I-IV-III. Eye diameters and eye interdistances. AME 0.08, ALE 0.09, PME 0.07, PLE 0.08,

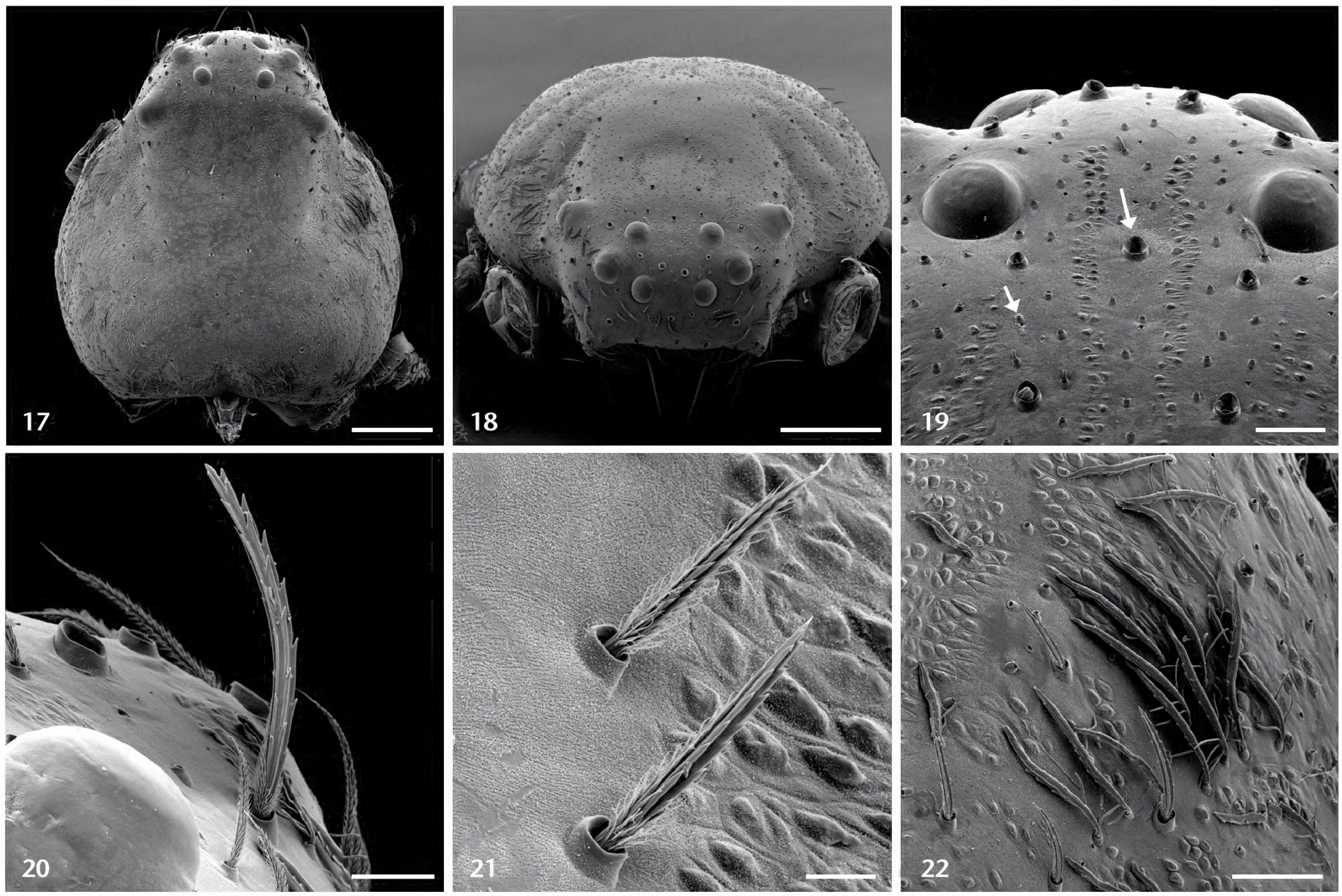



Figures 11–16. Palp of *Berlandiella zabele* sp. nov.: (11) ventral; (12) detail of apical portion of tegulum; (13) dorsal (arrow indicates scopula in apex of cymbium); (14) scopula in cymbium (indicated by arrow); (15) detail of CP (indicated by arrow) and RTA; (16) detail showing excavation in the RTA. CP: cymbial process, RTA: retrolateral tibial apophysis. Scale bars: 11 = 200 µm, 12, 15, 16 = 50 µm, 13 = 150 µm, 14 = 20 µm.

AME-AME 0.15, AME-ALE 0.08, PME-PME 0.22, PME-PLE 0.27. MOQ 0.25 long in frontal view, 0.22 in dorsal view, anterior width 0.30, posterior width 0.36.

Male (paratype – MPEG.ARA 34480). Shape and bristles of carapace (Figs 17–22) as in female; median region dark yellow with a brown central spot and wide dark brown bands on each side, formed by a tangle of dark spots. Clypeus as in female. Chelicerae as in female. Shape of labium and endites as in female; labium brown and endites pale yellow with some brown spots. Sternum pale yellow, mottled with brown. Legs covered by various types of setae and abundant macrosetae in tibiae and metatarsi (Figs 24, 42). Tarsi and metatarsi with dense scopula (Figs 17, 18). Arrangement of the ventral macrosetae of the tarsi and metatarsi I-II as in female. Trichobothria (Fig. 42) as in female. Femura yellow shaded with brown, with a transversal white stripe at the apex and yellow longitudinal stripe on retrolateral side; dorsum of the patellae yellow with a longitudinal brown stripe in the middle and a transversal white stripe at the apex, venter shaded with brown; base of the tibiae shaded with brown, the remaining yellow stippled with brown; base and apex of the tarsi shaded with brown, the remaining yellow stippled with brown; metatarsi yellow with a small brown spot at the base. Abdomen brown, oval, wider than long with many brown bristles curved backwards on the dorsum and sides; anteroventral region yellow. Palpal cymbium dark yellow covered by many setae, including scopula in the apex (Figs 13, 14), cymbial process present; elongated and robust bulb with a small and irregular membranous conductor below the embolus, which is short, sharp and straight; RTA semi-translucent.

Measurements. Total length 3.72. Carapace 1.49 long, 1.51 wide, 0.51 high. Chelicerae 0.44 long, 0.25 wide. Labium 0.17 long, 0.22 wide. Endites 0.37 long, 0.17 wide. Sternum 0.82 long, 0.75 wide. Clypeus 0.17 high. Abdomen 1.41 long, 1.00 wide, 0.66 high. Legs: I. femur 1.24; patella 0.59; tibia 1.03; metatarsus 0.89; tarsus 0.63; total length 4.38; II. 1.50; 0.60; 1.25; 1.00; 0.68; 5,03; III. 1.24; 0.50; 0.97; 0.76; 0.50; 3.97; IV. 1.35; 0.54; 1.08; 1.05; 0.51; 4.53. Leg formula: II-IV-I-III. Eye diameters and eye interdistances. AME 0.08, ALE 0.07, PME




Figures 17–22. Carapace of *Berlandiella zabele* sp. nov. male: (17) dorsal; (18) anterodorsal; (19) detail of tegument with many sockets of setae (indicated by arrows); (20) strong setae in the cephalic region; (21) hairs; (22) scales in the lateral of carapace. Scale bars: 7, 20 = 30 µm, 18 = 300 µm, 19, 22 = 50 µm, 20 = 30 µm, 21 = 10µm.

0.06, PLE 0.10, AME-AME 0.12, AME-ALE 0.05, PME-PME 0.20, PME-PLE 0.18. MOQ 0.21 long in frontal view, 0.19 in dorsal view, anterior width 0.24, posterior 0.32.

Material examined. BRAZIL. *Piauí*: Piracuruca, Parque Nacional de Sete Cidades, 04°05'39.9"S, 41°43'53.3"W, 02 Feb. 2007, LS Carvalho et al. leg. (1 female, MPEG.ARA 15576); same collection data as for preceding, 24 May. 2007, LS Carvalho et al. leg. (1 female, MPEG.ARA 15577); same collection data as for preceding, 22 Jan. 2007, LS Carvalho leg. (2 males, MPEG.ARA 15578); same collection data as for preceding, 02 Dec. 2006, NF Lo-Man-Hung leg. (1 female, MPEG.ARA 15580); same collection data as for preceding, 24 Jan. 2007, LS Carvalho leg. (2 males, MPEG.ARA 15581); same collection data as for preceding, 26 Jan. 2007, LS Carvalho et al. leg. (1 male, MPEG.ARA 15582); same collection data as for preceding, 02 Feb. 2007, LS Carvalho et al. leg. (1 male, MPEG.ARA 15583); same collection data as for preceding, 04°5'57.5"S, 41°43'0.7"W, 22 Jan. 2007, FM Oliveira-Neto leg. (1 male, MPEG.ARA 34478); Brasileira, 04°08'08.2"S, 41°43'08.4"W, 29 Jan. 2007, LS Carvalho et al. leg. (1 male, MPEG.ARA 34479); same collection data as for preceding, 28 Jan. 2007, LS Carvalho leg. (1 male, MPEG.ARA 34481).

Distribution. Known only from the type locality (Fig. 44).

Etymology. The specific epithet refers to a mythological character known by indigenous people of Piauí. According to indigenous mythology, Zabelê, a member of the Amanajós tribe, fell in love with Metara, a member of an enemy tribe. When the romance of Zabelê and Metara was discovered, tribal warfare resulted in the death of both lovers. The god Tupã pitied the two lovers and so transformed them into birds that fly together for eternity.

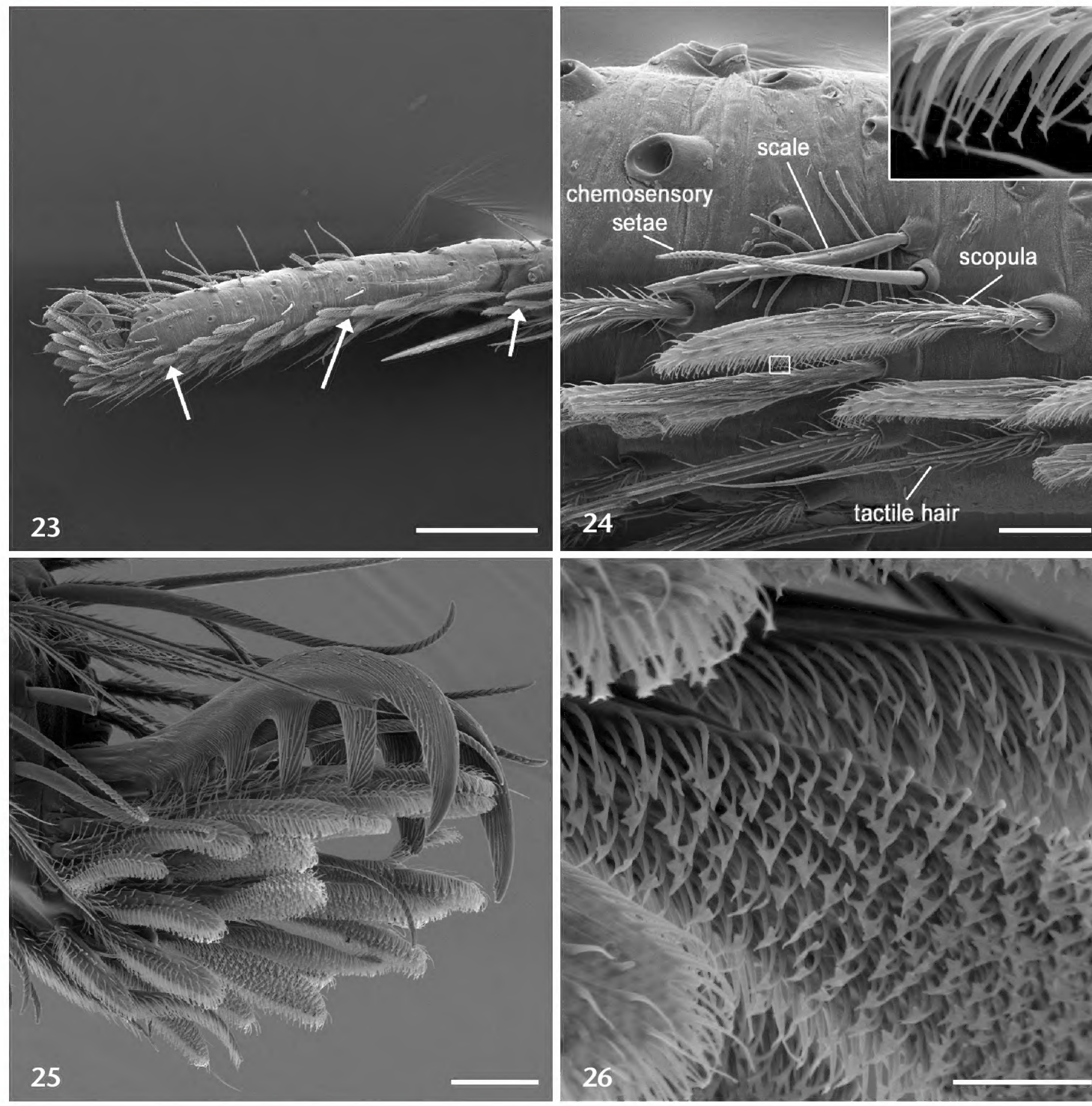
Remarks. The general color, legs especially, vary in the abundance of brown spots and some specimens may be darker or lighter than the paratype. The pattern of ventral macrosetae of the legs also varies between individuals.

## *Berlandiella querencia* Lise & Silva, 2011

Figs 1, 27–43, 44

*Berlandiella querencia* Lise & Silva, 2011: 368, figs 1, 100–111 (holotype from Querência, Mato Grosso, Brazil, deposited in MPEG 17571; examined).

Diagnosis. The male of *B. querencia* differs from the other species of the genus by having a sinuous CP, directed to the apex of the RTA (Figs 31, 33), which is robust, excavated, and with a




Figures 23–26. Leg I of *Berlandiella zabele* sp. nov. male: (23) tarsus and apex of metatarsus with scopula (indicated by arrows); (24) different types of seta in the metatarsus (smaller rectangle show tenent barbs of scopula); (25) claw and claw tufts; (26) detail of tenet barbs of claw tufts. Scale bars: 23 = 150 µm, 24, 25 = 20 µm, 26 = 5 µm.

straight apex (Figs 31, 33).

Description. Male (MPEG.ARA 34477). Carapace slightly longer than wide, wider on the level of legs III, narrowed in front, with many sockets of bristles (Figs 17–22), similar to female; median region yellow with wide brown bands on each side, formed by a tangle of dark spots. Clypeus brown, vertical, with many sockets of bristles. Chelicerae yellow, with two teeth on the promargin of the fang furrow, with a large dark brown spot on the anterior face. Labium brown with rounded apex, reaching almost the middle of the endites. Endites pale yellow with some brown spots, excavated diagonally. Sternum pale yellow with some circular brown spots on its lateral margins. Legs covered by various types of setae with abundant macrosetae on tibiae and metatarsi. Left tibia I with 2–2–2–2–1 ventral macrosetae and left metatarsi I with 2–2–0 ventral macrosetae; right tibia I with 2–2–2–2 ventral macrosetae and right metatarsus I with 2–2–0 ventral macrosetae. Left tibia II with 2–2–2–2 ventral macrosetae and left metatarsus II with 2–2–0 ventral macrosetae. Tarsi and metatarsi with dense scopula (Figs 35, 37, 39). Long and slender trichobothria in tarsus and metatarsus with distal and proximal plate limit well differentiated; the distal margin of the trichobothrial hood is well defined; hood entire, differentiated with transverse ridges; alveolus notched; distal plate smooth, slightly elevated. Femura, patellae, tibiae and metatarsi I-IV yellow shaded with brown; tarsi yellow. Tarsal claw pectinate and conspicuous with claw apex tooth curved and seven short and robust teeth. Abdomen oval, narrower on the posterior margin, excavated on the anterior margin; tegument yellow with many setae curved backwards, the dorsum covered by a wide brown spot with two longitudinal yellow bands around the heart mark; sides with a brown longitudinal stripe and the venter with small brown spots. Palpal cymbium dark yellow covered by many

Figures 27–30. *Berlandiella querencia*: (27) male habitus (MPEG.ARA 35228); (28) female habitus (MPEG.ARA 33973); (29) epigynum, ventral; (30) epigynum, dorsal clarified. Scale bars: 27–28: 1 mm, 29–30: 0.2 mm.

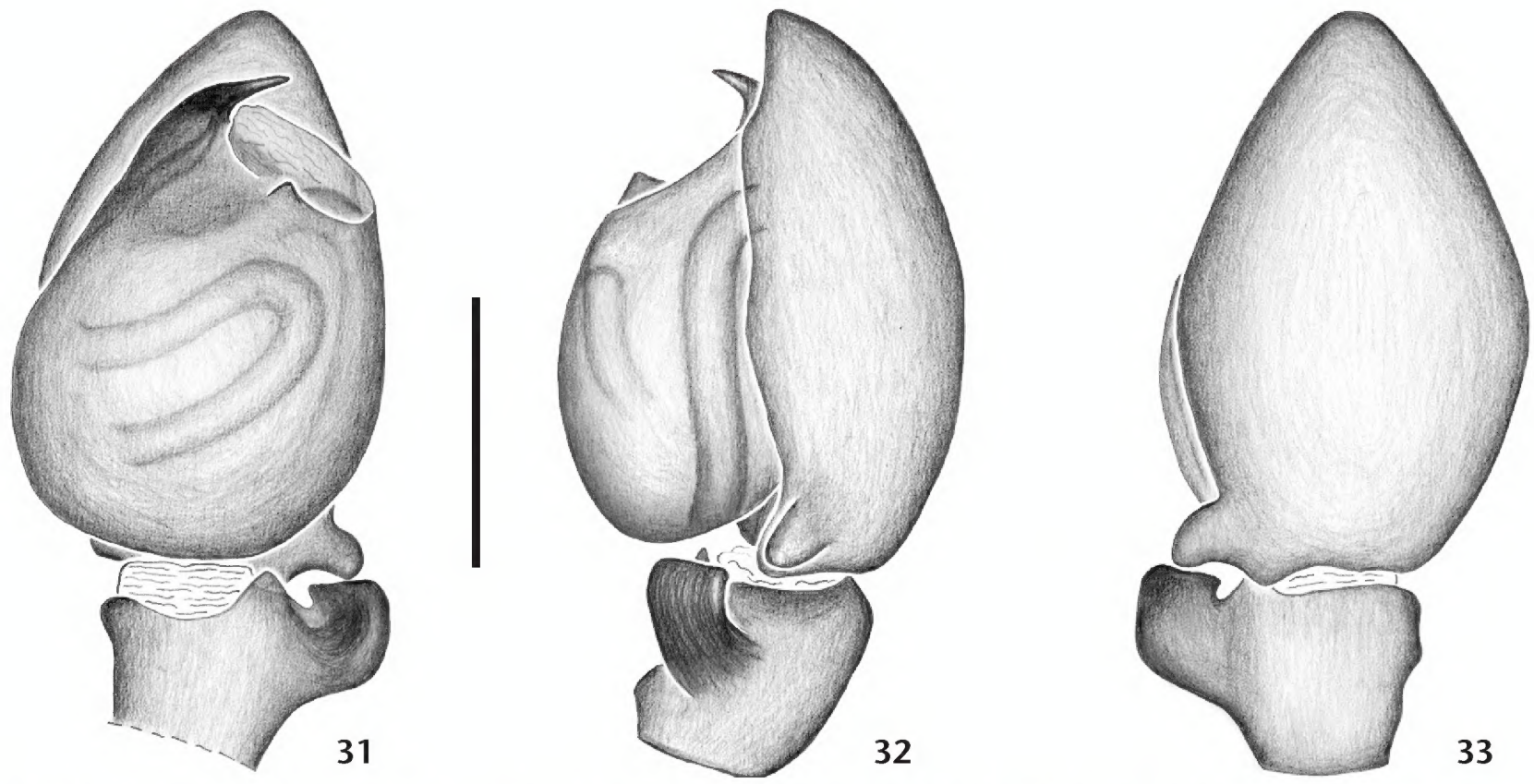
setae, including scopula in the apex, cymbial process present; covered by many setae, including scopula in the apex; ellipsoid and robust bulb, with small triangular process near embolus and semi-translucent lamella in the retrolateral apical portion; embolus short, sharp and straight; RTA semi-translucent, curved and elongated.

Measurements. Total length 2.84. Carapace 1.46 long, 1.03 wide, 0.39 high. Chelicerae 0.43 long, 0.25 wide. Labium 0.16 long, 0.23 wide. Endites 0.34 long, 0.17 wide. Sternum 0.81 long, 0.73 wide. Clypeus 0.16 high. Abdomen 1.38 long, 1.00 wide, 0.57 high. Legs: I. femur 1.06; patella 0.51; tibia 0.96; metatarsus 0.72; tarsus 0.52; total 3.77; II. 1.25; 0.53; 1.08; 0.84; 0.57; 4.26; III. 1.23; 0.44; 0.83; 0.71; 0.50; 3.71; IV. 1.22; 0.46; 1.00; 0.92; 0.47; 4.07. Leg formula II-I-IV-III. Eye diameters and eye interdistances: AME 0.08, ALE 0.7, PME 0.06, PLE 0.10, AME-AME 0.8, AME-ALE 0.05, PME-PME 0.15, PME-PLE 0.14, MOQ 0.19 long in frontal view, 0.19 in dorsal view, anterior width 0.25, posterior width 0.28.

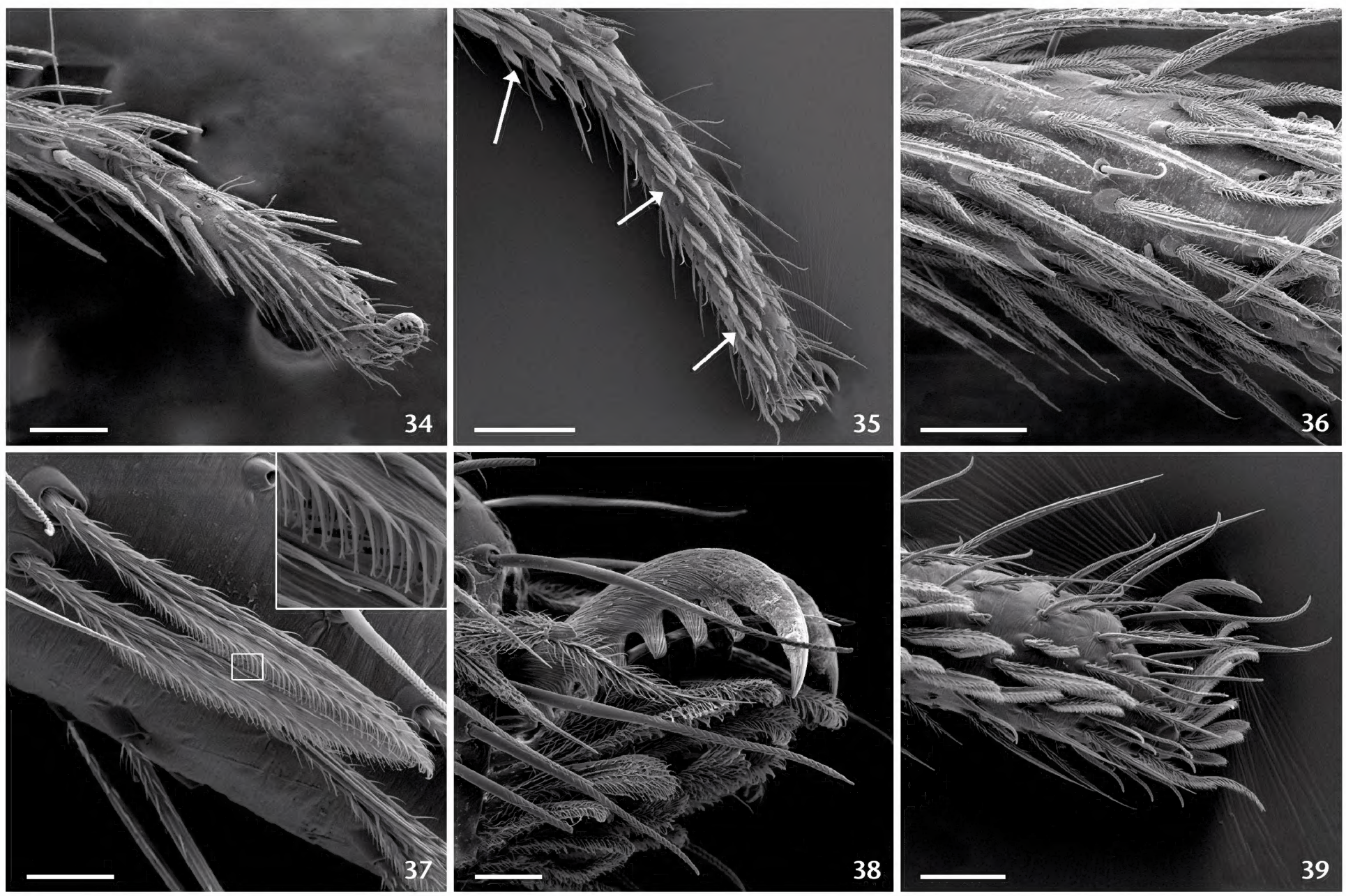
Female. See diagnosis and description in Lise and Silva (2011) and Figs 34, 36, 38 from female MPEG.ARA 33973 and Figs 29, 30 from female MPEG.ARA 33972.

Material examined. BRAZIL. *Pará*: Belém, Reserva Mocambo, 01°26'26.7"S, 48°24'40.5"W, 10 Jul. 2003, JAP Barreiros and DR Santos de Sousa leg. (1 male, MPEG.ARA 34477); same collection data as for preceding, Museu Paraense Emílio Goeldi – Campus de Pesquisa, 01°27'04.44"S, 48°26'39.32"W, 2011, (1 female, MPEG.ARA 33972); same collection data as for preceding, Oct. 2011 (1 female, MPEG. ARA 33973); same collection data as for preceding, 12 May 2018, P Pantoja leg. (1 male, MPEG.ARA 35228); *Mato Grosso*: Querência, Fazenda Tanguro, 12°55'53.0"S, 52°26'49.1"W, 13 Jun. 2006, DF Candiani and NF Lo-Man-Hung leg. (1 female, MPEG.ARA 16716).

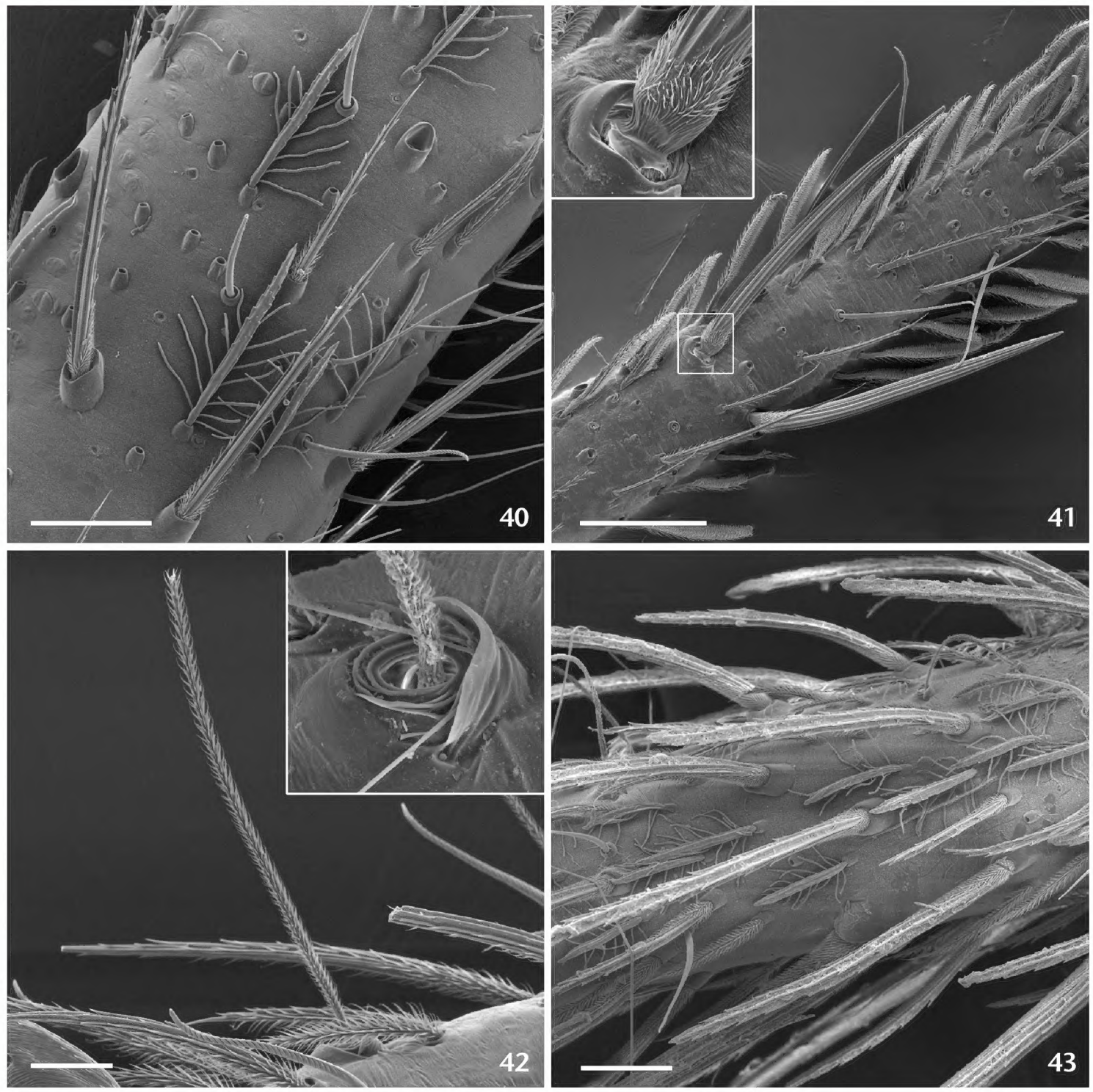
Distribution. Known from Brazil (Mato Grosso and Pará) (Fig. 44).




Figures 31–33. Palp of *Berlandiella querencia:* (31) palp, ventral; (32) palp, retrolateral; (33) palp, dorsal. Scale bars: 0.3 mm.




Figures 34–39. Leg I of *Berlandiella querencia:* (34, 36, 38) female; (35, 37, 39) male; (34-35) metatarsus and apex of tarsus (arrows to scopular setae); (36) detail of setae in tarsus; (37) scopula, smaller rectangle show tenent barbs of scopular seta; (38-39) claw and claw tufts. Scale bars: 34, 35 = 150 µm, 36, 39 = 50 µm, 37, 38 = 20 µm.




Figures 40–43. Setae: (40) setae on the side tibia of *B. querencia* male; (41) pair of macrosetae in the venter of tibia I of *B. zabele* male; (42) trichobothrium on the dorsum of tarsus I of *B. zabele* male; (43) strong bristles on the side of the metatarsus of *B. querencia* female. Scale bars: 40, 43 = 50 µm, 41 = 100 µm, 42 = 20 µm.

## DISCUSSION

We present an updated diagnosis of *Berlandiella* based on the revision carried out by Lise and Silva (2011). Scopula was not recognized in *Berlandiella* specimens in the description of the type species *B. insignis* by Mello-Leitão (1929) and by Lise and Silva (2011). Until now the absence of this structure was considered as on one of the diagnostic features of the genus. However, we found scopula in the anterior legs of both males and females of *B. zabele*, males of *B. querencia*, *B. magna* (MCTP-31691), and *B. meridionalis* (MCTP-24716, MCTP-24718), although the scopula of the latter two species is less dense. Apparently some male and female specimens of *B. meridionalis* (MCTP-18928, MCTP-35602) lack scopula. In addition, figure 71 in Lise and Silva (2011) shows scopular setae in a section of one leg of *B. robertae*, indicating that other species of the genus also have scopula. The type-species of the genus, *B. insignis*, was not examined.

Scopula seem to be present only in sexually mature individuals, since we analyzed a juvenile of *B. querencia* without this structure. The scopular setae appeared in the anterior legs after ecdysis, when the specimen reached sexual maturity, becoming an adult male (MPEG.ARA 35228). Although we have not examined all species of the genus, it is clear that scopula should not be used to diagnose *Berlandiella* because the presence/absence of this structure varies among specimens of the same species and with degree of maturity.

We also removed from the diagnosis any mention about the height of the carapace, as well as the presence of dense claw tufts. In fact, some females of *Berlandiella* may have a relatively high carapace, and even males have convex carapace, although it is lower than females. As the understanding about the height

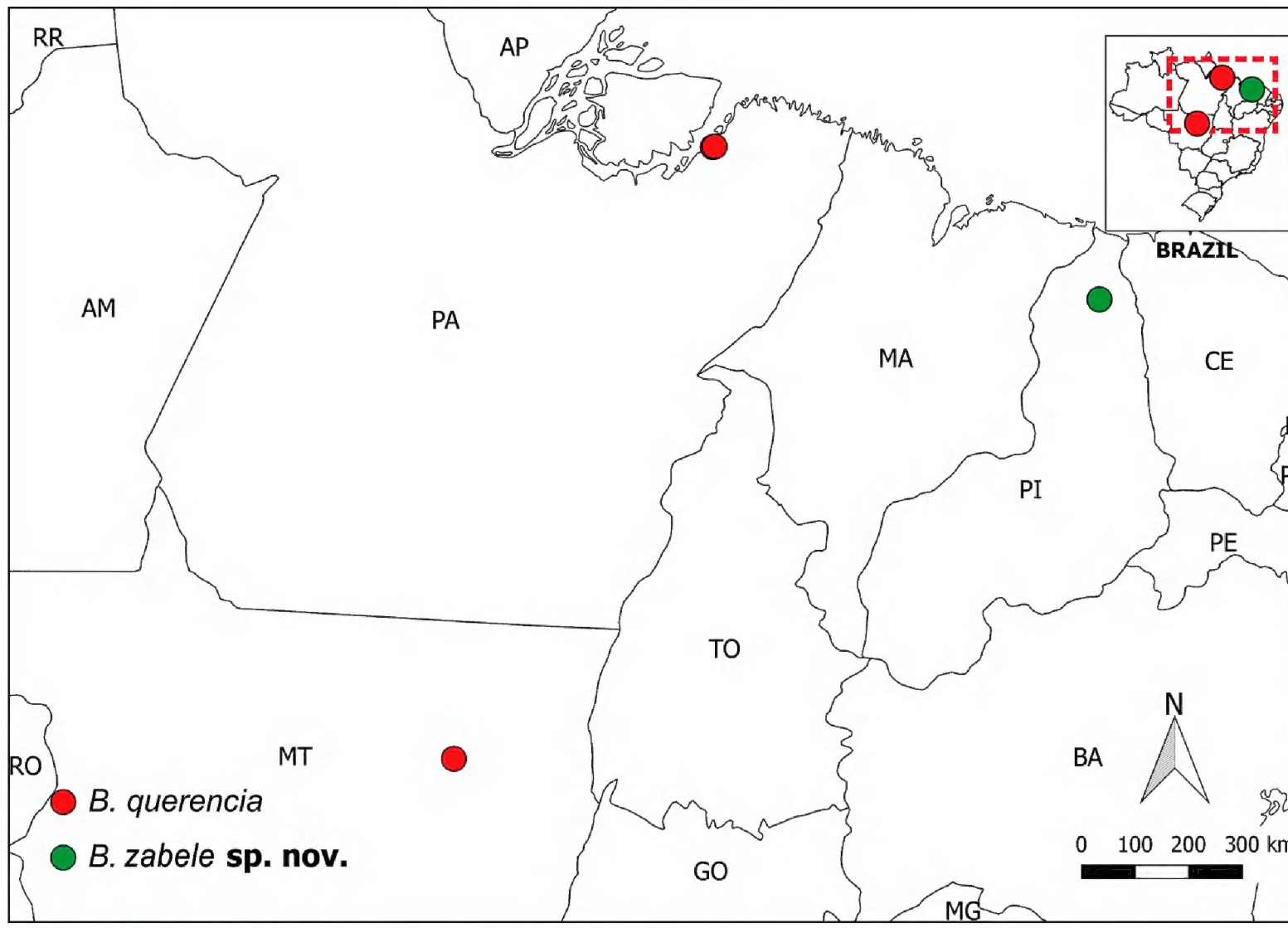



Figure 44. Distribution map of *Berlandiella zabele* sp. nov. and *B. querencia*.

of the carapace is subjective, we decided to remove this character from the diagnosis. The use of claw tufts in the genus diagnosis is not informative, since these structures are present in many others genera of Philodromidae.

Since we documented the presence of the scopula in *Berlandiella* specimens, the absence of this character used to separated *Berlandiella* from *Cleocnemis* become invalid and was removed from the diagnosis. As consequence we could not establish a clear limit between *Berlandiella* and *Cleocnemis*. The original description of the type species, *C. heteropoda* Simon, 1886, as well as the redescription by Mello-Leitão (1929), present some somatic characters shared with *Berlandiella* representatives, such as a strongly recurved posterior eye row, with the PME smaller and more separated than in PLE; short legs with similar length, covered with many bristles, elongated bulbous male palp and short embolus. In addition, Mello-Leitão (1929) describes low carapace for some *Cleocnemis* species, including *C. heteropoda*, and high carapace for *Berlandiella*. However, some *Berlandiella* have relatively low carapace, which show us that this character is not informative, as discussed above.

The limits between *Berlandiella* and *Cleocnemis* should be established based on the detailed analysis of the *Cleocnemis* type species, as well as a phylogenetic analysis to understand the relationship between the two genera. Both are beyond of the scope of this paper, although we have the concern of not describing a new taxa which can become a synonym of a species already described and allocated in *Cleocnemis*. Then, to make sure that *B. zabele* has not been already described under *Cleocnemis* we checked the type localities, original descriptions and illustrations for all 14 known species of this genus as follow summarized: *C. bryantae* (Gertsch, 1933), *C. lanceolata* Mello-Leitão, 1929, *C. nigra* Mello-Leitão, 1943, *C. paraguensis* (Gertsch, 1933), *C. spinosa* Mello-Leitão 1947, *C. taquarae* (Keyserling, 1891) and *C. xenotypa* Mello-Leitão, 1929 differ from *B. zabele* based on the genitalia. *Cleocnemis moschata* Mello-Leitão, 1943 and *C. rosea* Mello-Leitão, 1944 has several ventral macrosetae in the legs I-II and *B. zabele* has only 2–2 ventral macrosetae in this legs. *Cleocnemis mutilata* (Mello-Leitão, 1917), *C. punctalata* (Taczanowski, 1872), *C. rudolphi* Mello-Leitão, 1943 and *C. serrana* Mello-Leitão, 1929 has several somatic characters different from *B. zabele*, especially legs with unequal length. *Cleocnemis nigra* and *C. rudolphi* were registered from the state of Paraíba, relatively close to the type locality of *B. zabele*, however, differs from this species by the previously mentioned characters. The description of *C. heteropoda* is similar to *B. zabele* based on somatic characters, however, *C. heteropoda* occurs in Rio de Janeiro, relatively far from the type locality of *B. zabele*. Additionally, the *heteropoda* epithet refers to unequal legs, as indicated by Mello-Leitão (1929) in the redescription of the species. On the other hand, *B. zabele* has all legs similar in color and length.

About the new characters described for *Berlandiella* here, males of *B. zabele* sp. nov. and *B. querencia* present a cymbial

process, which differs from all other males of the genus. A similar structure occurs in several species of *Philodromus* Walckenaer, 1826 and has been called the paracymbial lamella (Braun 1965), tutaculum (Levy 1977), cymbial process (Muster and Thaler 2004), and dorsal cymbium bulge (Muster 2009). The paracymbial lamella refers to a thin structure projected from the cymbium, which is different from that found in taxa described here. The tutaculum, used by Levy (1977), is a specific term to define a type of cymbial process that houses the embolus tip, which functions like a conductor in some genera of Thomisidae (Comstock 1940, Schick 1965, Benjamin 2011) and is different from the structure described here. In relation to the cymbium bulges, analyzing the illustrations of Muster (2009), we concluded that such structures are irregular projections on the dorsum of the cymbium, also different from the structure described here. Finally, Muster and Thaler (2004) described cymbial process as a small projection at the retrolateral proximal ventral border of cymbium, similar to structure found in males of *B. zabele* and *B. querencia*. Therefore, we decided to adopt this terminology for this structure.

Structures that emerge from the margin of the cymbium have been defined several times in the literature as paracymbium (see Griswold et al. 2005), however, this term is widely used to define cymbial projections present in Araneoidea palps, often being indicated as a group synapomorphy (Griswold et al. 1998, Griswold et al. 2005). In order to avoid misunderstandings, we decided not to use the term paracymbium to designate the structure present at the base of the cymbium of *B. zabele* and *B. querencia*; rather, we instead use the term cymbial process.

Finally, despite the difficulty in distinguishing *Cleocnemis* from *Berlandiella*, this latter is a revised genus and presents uniformity in the diagnostic characters present in the type-species and in the others (see diagnosis above). For this reason, and due to the similarity between *B. zabele* and other *Berlandiella* species, we decided to allocate the species in this genus.

## ACKNOWLEDGMENTS

We would like to thank the Museu Paraense Emílio Goeldi (MPEG) by providing the laboratory structure to carry out this work, especially Alexandre Bonaldo, responsible for the Laboratório de Aracnologia of the MPEG. We also thank Hilton Tulio Costi and Laura Miglio for providing the use of the SEM lab of MPEG and for all support given to the authors. We are very grateful to the reviewers and the editor for their careful reading of the text, for all valuable comments and suggestions, which were very helpful in improving the paper: Cristina Anne Rheims, Martín Ramírez, Ricardo Pinto-da-Rocha and anonymous. Finally, we greatly thank André Prado for our discussions about *Cleocnemis* taxonomy. The authors were supported by the following grants: PP – Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq, 130702/2019-6) and Programa de Pós-graduação em Zoologia – UFPA/MPEG; MD – Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES, 88882.442371/2019-01) and Programa de Pós-graduação em Biodiversidade e Evolução – MPEG; RS – PandD ANEEL/CELPA # PD-0371-0017/2013. The laboratory facilities at Museu Paraense Emílio Goeldi were provided by Project #3362 CELPA/FADESP Monitoramento (REF.: 061/2013), also coded at Agência Nacional de Energia Elétrica (ANEEL) as PD-0371-0017/2013, entitled "Monitoramento dos possíveis impactos da linha de transmissão do Marajó sobre a fauna." The last version of this paper was written when RS was supported by the Project #1199/FSADU (Fundação Sousândrade de Apoio ao Desenvolvimento da UFMA), entitled "Desenvolvimento experimental de metodologia para a detecção e redução de fatores de vulnerabilidade da vegetação que causam interrupções no fornecimento de energia", funded by Companhia Energética do Maranhão-CEMAR.

## LITERATURE CITED

Benjamin SP (2011) Phylogenetics and comparative morphology of crab spiders (Araneae: Dionycha, Thomisidae). Zootaxa 3080: 1–108.

Braun R (1965) Beitrag zu einer Revision der paläarktischen Arten der *Philodromus aureoles*-Gruppe (Arach., Araneae). I. Morphologischsystematischer Teil. Senckenbergiana Biologica 46: 369–428.

Comstock JH (1940) The external anatomy of spiders. In: Comstock JH (Ed.) The Spider Book. Cornell University Press, Ithaca, 95–136.

Griswold CE, Coddington JA, Hormiga G, Scharff N (1998) Phylogeny of the orb-web building spiders (Araneae, Orbiculariae: Deinopoidea, Araneoidea). Zoological Journal of the Linnean Society 123: 1–99. https://doi.org/10.1111/j.1096-3642.1998.tb01290.x

Griswold CE, Ramírez MJ, Coddington JA, Platnick NI (2005) Atlas of phylogenetic data for entelegyne spiders (Araneae: Araneomorphae: Entelegynae) with comments on their phylogeny. Proceedings of the California Academy of Sciences 56: 1–324.

Levy G (1977) The philodromid spiders of Israel (Araneae: Philodromidae). Israel Journal of Zoology 26: 193–229.

Lise AA, Silva ELC da (2011) Revision of the Neotropical spider genus *Berlandiella* (Araneae, Philodromidae). Iheringia. Série Zoológica 101: 350–371. https://doi.org/10.1590/S0073-47212011000300010

Mello-Leitão CF (1929) Aphantochilidas e Thomisidas do Brasil. Arquivos do Museu Nacional do Rio de Janeiro 31: 9–359.

Muster C (2009) Phylogenetic relationships within Philodromidae, with a taxonomic revision of *Philodromus* subgenus *Artanes* in the western Palearctic (Arachnida: Araneae). Invertebrate Systematics 23: 135–169. https://doi.org/10.1071/IS08044

Muster C, Thaler K (2004) New species and records of Mediterranean Philodromidae (Arachnida, Araneae): I. *Philodromus aureolus* group. In: Thaler K (Ed) Diversität und Biologie von

Webspinnen, Skorpionen und anderen Spinnentieren. Biologiezentrum/Oberöster-reichisches Landesmuseum Linz, Austria, 305–326.

QGIS Development Team (2019). Quantum GIS Geographic Information System. Version 2.18.0. Open Source Geospatial Foundation Project. https://www.qgis.org/en/site/index.html

Santos FH, Rheims CA (2018) Taxonomic revision of the genus *Gephyrellula* Strand, 1932 (Arachnida, Araneae, Philodromidae). Zootaxa 4527(3): 381–391.

Schick RX (1965) The crab spiders of California (Araneae, Thomisidae). Bulletin of the American Museum of Natural History 129: 1–180. http://hdl.handle.net/2246/1114

WSC (2020) World Spider Catalog. Version 20. Natural History Museum, Bern. http://wsc.nmbe.ch

Submitted: June 16, 2019
Accepted: October 25, 2019
Available online: April 7, 2020
Editorial responsibility: Ricardo Pinto da Rocha

Author Contributions: PP made the drawings and obtained the SEM images; PP, MD-B and RS examined, sorted and identified the material and wrote the paper.

Competing Interests: The authors have declared that no competing interests exist.

© 2020 Sociedade Brasileira de Zoologia. Published by Pensoft Publishers at https://zoologia.pensoft.net